Noise Analysis

for the

Pinedale Anticline Oil and Gas Exploration and Development Project

Sublette County, Wyoming

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

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This Noise Analysis was prepared by Air Sciences, Inc., an environmental consulting firm, with the guidance, participation, and independent evaluation of the Bureau of Land Management and cooperating agencies. The Bureau of Land Management and the cooperating agencies, in accordance with 40 CFR 1506.5(a) and (b), are in agreement with the findings of the analysis and approve and take responsibility for the scope and content of this document.

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1.0 BASELINE CONDITIONS

The U.S. EPA has published existing noise level data for areas with various types of noise-generating activity (EPA 1971)[1]. This published data is commonly used to estimate existing noise levels in areas where site-specific noise measurements have not been taken. The Pinedale Anticline Project Area (PAPA) has background noise generating activity similar to the EPA's category of "Farm in Valley". The median outdoor noise levels (L_{50}) for this category are:

Daytime	-	39 dBA
Evening	-	39 dBA
Nighttime	-	32 dBA

Local conditions such as traffic, topography, and the frequent high winds characteristic of this region can alter these background noise conditions to a minor degree.

2.0 DEFINITION OF SIGNIFICANT IMPACT

Neither the state of Wyoming, nor Sublette County (where PAPA is located) have noise impact regulations or standards. The U.S. Federal Energy Regulatory Commission (FERC) has developed noise impact regulations for use on its projects. This standard is considered appropriate for this project and is used herein.

The FERC standard for any applicable compressor facility is a day-night sound level (L_{dn}) of 55 dBA at the nearest receptor. For a constant noise source such as a drill rig or compressor facility, this is equivalent to an L_{eq} of 49 dBA throughout the 24 hours of the day (18 CFR, 157.206)[2].

There are no standards of noise protection for wildlife; however, for this study an increase of 10 dBA above background is likely to be acceptable. Given a background of 39 dBA in the daytime and the evening, this is equal to the FERC level for constant noise generators (49 dBA). At nighttime it is equal to 42 dBA.

3.0 DEFINITION OF THE SOURCES

Two noise sources were analyzed for the PAPA, a drill rig and a compressor facility.

The noise impacts from a typical drill rig for Wyoming gas drilling was measured at a sound pressure level (SPL) of 63 dBA at 200 feet from the rig (PIC, 1998)[3]. Using the following formula, a power level (PWL) of 107.0 was calculated. This is considered representative of a typical PAPA drill rig.

$$\text{PWL (dBA)} = \text{SPL (dBA)} + 20\ (\text{LOG(distance in feet)}) - 2$$

$$\text{PWL (dBA)} = 63 + 46.0 - 2 = 107.0\ \text{dBA}$$

The assumed operating schedule is 24 hours per day for up to 2 weeks.

The compressor stations could be up to 26,000 hp using internal combustion engines. The noise impacts from a typical compressor for compression of natural gas was analyzed. These impacts were established from power levels (dBA) measured at the Burro Canyon Compressor Station located near Trinidad, Colorado, which consists of three 3,000 hp compressors operating at 80 percent load (Air Sciences, 1998)[4]. For operating schedule, we assume 24-hour-per-day operation, 365 days per year. The power level for the 26,000 hp PAPA Station was determined from the power level measured near the 9,000 hp Burro Canyon Station using the following formula:

$$\text{PWL (PAPA, dBA)} = \text{PWL Burro} + 10\text{Log (PAPA Station capacity/Burro Canyon Station capacity)}$$

The PWL of the Burro Canyon Facility is provided in Table 1 for each of the nine octave bands. Table 1 also provides the distance and power ratio factor to convert the Burro Canyon PWL to a PWL representative of the PAPA facility.

TABLE 1
SOUND POWER LEVEL - COMPRESSOR FACILITY
26,000 HP CAPACITY

	Octave Band Center Frequency (Hz)									dBA
	31.5	63	125	250	500	1,000	2,000	4,000	8,000	
7,200 hp[1]	69.6	74.3	65.8	61.3	62.3	64.2	63.4	56.2	37.5	68.6
Distance term (20Log(350)-2)	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	48.9	--
Correct for hp and capacity[2]	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	--
26,000 hp PWL	124.1	128.8	120.3	115.8	116.8	118.7	117.9	110.7	92.0	123.1

[1] Sound power level from Burro Canyon.
[2] Pinedale 26,000 hp @100% capacity, Burro 9,000 hp @ 80% capacity.

These values assume that no buildings are surrounding the compressors. The sound power level for a 26,000 hp compressor facility is 123.1 dBA.

4.0 DEFINITION OF THE ENVIRONS

The PAPA consists of relatively flat, dry rangeland with sparse, low vegetation and few trees. The land is normally used for grazing. For the purpose of noise propagation, it was assumed that the terrain is flat with no forestation. There is dry ground in the warmer months and snow-covered ground in the wintertime. Nocturnal inversions are common in this area.

5.0 ATTENUATION DURING PROPAGATION

Noise propagation was estimated considering the effects of hemispheric divergence, atmospheric attenuation, and anomalous excess attenuation. The effects of meteorology, terrain, and trees were not considered. This results in a conservatively high prediction of noise impacts. Hemispheric divergence, atmospheric attenuation (atm. atten.), and anomalous excess attenuation (anom. atten.) were used as follows:

SPL (dBA) = PWL (dBA) - divergence (dBA) - atm. atten. (dBA) - anom. atten. (dBA)

where: divergence = 20 LOG (distance) - 2

atm. atten. and anom. atten. coefficients are provided in Table 2

TABLE 2
ATMOSPHERIC AND ANOMALOUS ATTENUATION COEFFICIENTS*

	Octave Band Center Frequency (Hz)								
	31.5	63	125	250	500	1,000	2,000	4,000	8,000
Atmospheric attenuation coefficients (dBA/1,000 feet)	0.0	0.1	0.2	0.4	0.7	1.5	3.0	7.6	13.7
Anomalous attenuation coefficients (dBA/1,000 feet)	0.3	0.4	0.6	0.8	1.1	1.5	2.2	3.0	4.0

* Miller, 1981[5]

Each sound power level was attenuated and tabulated at the following distances: 100, 200, 500, 1000, 1500, 2000, 3000, 5000, 10000 feet.

6.0 NOISE IMPACTS

Noise levels were predicted at various distances from the PAPA Facility using the previously discussed power levels and propagation attenuation functions. Results are provided in Table 3.

TABLE 3
IMPACT NOISE LEVELS

Distance From Source (feet)	26,000 hp Compressors (dBA)	Drill Rig (dBA)
100	84.6	68.8
200	78.3	62.7
500	69.0	54.0
1,000	61.3	47.2
1,500	56.2	42.7
2,000	52.3	39.4
3,000	46.2	34.1
5,000	37.5	26.0
10,000	24.5	11.0

From this table it is apparent that noise impact from drill rigs becomes significant (greater than 49 dBA) when the rig is located closer than about 800 feet to a receptor. Impact from a 26,000 hp compressor station is significant when located closer than about 2,500 feet to a receptor.

7.0 MITIGATION

Because of the temporary nature of drill rigs, mitigation is not normally used, except to locate them at a greater distance from the sensitive receptors. If necessary, certain measures of mitigation are available to decrease the compressor station noise levels.

The compressors are usually at least partially exposed to the environment due to engine cooling requirements. However, the compressor engines are normally protected from the weather by a non-insulated metal building. A compressor building is typically constructed of 20-gauge steel with a compressor-cooling fan mounted on the side of the building so that it draws in exterior air. Fan noise will propagate with no building mitigation, but engine and compressor noise can be decreased by 5 to 10 dBA because of the building. There is a single exhaust stack for each engine with an industrial grade muffler that vents vertically above the roof. An additional suppression structure can be installed around the muffler exhaust for noise reduction.

REFERENCES

[1] U.S. EPA, Community Noise, 1971.

[2] U.S. EPA, 18 CFR, Chapter 1, 4-1-98 Edition, 157.206, 1998.

[3] Information collected by PIC Technologies, Inc., 1998.

[4] Air Sciences Inc., Ambient Noise Impact Analysis Tamburelli Ranch Compressor Station, 1998.

[5] Layman N. Miller, BBN, Noise Control for Buildings and Manufacturing Plants, 1981.